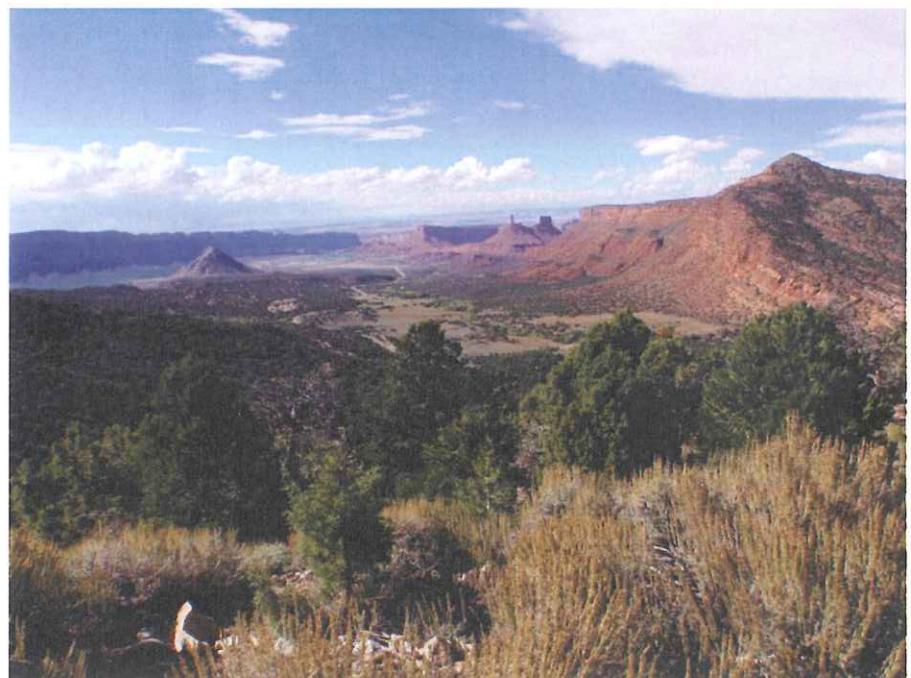


MANTI-LA SAL NATIONAL FOREST

UT PFH 46-1(2) LA SAL MOUNTAIN LOOP ROAD

PAVEMENT REPORT Report # 11-02

Pavements Section
April 2011



SIGNATURE SHEET

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RECOMMENDED PAVEMENT TYPICAL STRUCTURAL SECTION

La Sal Mountain Loop 20 Year Design:
3 inches HACP
6 inches FDR- Pulverization
3 inches Existing Base Course

I. INTRODUCTION AND BACKGROUND

This report presents the pavement recommendations for La Sal Mountain Loop Road, UT PFH 46-1(2), in Manti-La Sal National Forest. This report will base the pavement recommendations on the following factors:

- Pavement alternatives
- Existing pavement and subgrade conditions
- Field investigations
- Laboratory analysis

La Sal Mountain Loop Road, locally known as CR 1706, FH-46, and La Sal Scenic Backway, begins 6 miles south of Moab Utah and loops throughout Manti-La Sal National Forest toward Castle Valley. A field investigation was performed on November 16th, 2010 by Beau Williams and Danielle Germani from Central Federal Lands. The purpose of the investigation was to record pavement conditions and gather samples between mileposts 2.0 and 26.0.

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Figure 1. Project Location Map. Shows a map of the project.

II. EXISTING PAVEMENT AND SUBGRADE CONDITIONS

The existing roadway is an average of 22.5-feet wide. La Sal Mountain Loop Road is distressed and records show that the road has not been repaved in a number of years. Crack seal and evidence of chip seals are visible on the road surface along the entire project. Fatigue cracking is also found along portions of the roadway. Figure 1 shows the fatigue cracking along La Sal Mountain Loop Road. Telephone lines are located along the ditch of the road approximately 20-feet from the edge of pavement. No utilities were located in the middle of the roadway. Multiple culverts also exist within the project.

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Figure 1. Fatigue cracking along La Sal Mountain Loop Road.

The existing pavement thickness varies from less than 1 inch to 3 inches on the mainline with an average of 1.5-inches. The aggregate base material varies in thickness from 3-inches to 34-inches with an average depth of 10-inches. Table 1 below shows the pavement, base, and subgrade thicknesses for every milepost from the field investigation. The average depths are calculated using depths drilled every quarter mile. Some discrepancies may occur between the mileposts listed in the tables and the milepost signs in the field. The table below only shows depths at every mile marker. The complete table of every quarter mile boring is shown in Appendix A in the back of this report.

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Table 1. Thicknesses for pavement, base, and subgrade from the investigation

UT PFH 46-1(2) Recorded Thicknesses					
Location (M.P.)*	Boring	Side	Asphalt (inches)	Base (inches)	HACP + Base (inches)
3.0	4	Rt	1.5	18	19.5
4.0	8	Rt	2	14	16
5.0	12	Rt	3	4	7
6.0	16	Rt	1	8	9
7.0	20	Rt	1.5	10	11.5
8.0	24	Lt	2	6	8
9.0	28	Lt	1	11	12
10.0	32	Lt	1.5	5	6.5
11.0	36	Lt	7	5	12
12.0	40	Rt	3	5	8
13.0	44	Rt	2	7	9
14.0	48	Lt	2	7	9
15.0	52	Lt	2	9	11
16.0	56	Lt	1	9	10
17.0	60	Rt	3	7	10
18.0	64	Rt	1	11	12
19.0	68	Lt	1	13	14
20.0	72	Lt	1	10	11
21.0	76	Rt	1	10	11
22.0	80	Lt	1	34	35
23.0	84	Lt	1	0	1
24.0	88	Rt	2	0	2
25.0	92	Lt	2	4	6
26.0	96	Lt	1	8	9

*Mileposts in this table may vary from actual field mileposts.

It should be noted that about 9% of the existing roadway consists of less than 9-inches of existing HACP and base course. In some areas throughout the project, A-6 and A-7 soils exist and these soils may be incapable of supporting traffic with a HACP and base course depth less than 11-inches. See Appendix A for these locations.

III. FIELD INVESTIGATIONS

On November 16, 2010 a two person crew from Western Technology drilled every quarter mile along La Sal Mountain Loop Road starting at milepost 2.0 continuing to milepost 26.0. Five-foot boring holes were drilled every mile, starting at milepost 3.0. In addition, one-foot bore holes were drilled every quarter mile. A total of 96 boring holes were drilled during the trip, including 24 five-foot holes and 72 one-foot holes. Sections of the road were covered in snow and ice but the majority of the road was clear and dry.

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The existing base material primarily consists of sandy gravels and gravelly sands. No base course material was found from milepost 22.0 to 24.0. Most of the material in this area is borrow material. The subgrade from milepost 2.0 to 26.0 consists mostly of sandy gravel and gravelly sands. The subgrade material consisted of clays from milepost 10.0 to 20.0. While drilling, large rocks were hit within the subgrade material making it impossible to drill down the full 5-foot depth at these locations. Refusal was anywhere between 24-inch and 32-inch depths. Refusal locations are noted in the field log.

Pavement, base, and subgrade samples were collected and sent to the laboratory for testing. The field investigation log for this site visit is in Appendix A. Photographs of the bore holes and soils found can be in Appendix C.

IV. TEST RESULTS

Samples were tested for soil classification, R-Values, and pH levels. The base course mostly consists of silty clayey sands.

The subgrade material consists of clayey soils. The R-Values ranges from 63 to 88 for the base material. The subgrade R-Values range from 4 to 41. The subgrade was also tested for hot soils resulting in a pH ranging from 7.1 to 7.7 and a resistivity ranging from 1000 to 1460 ohm x cm. Table 2 below provides the soils classifications, R-Values and plasticity index for the subgrade material at every milepost.

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Table 2. Classification, R-Values, and plasticity index for the subgrade.

UT PFH 46-1(2) R-Values						
Location (M.P.)*	Boring	Side	Sample Depth	AASHTO Classification	R-Value	Plasticity Index
3.0	4	Rt				
4.0	8	Rt	16"-58"	A-4 (1)	41	10
5.0	12	Rt	7"-55"	A-6 (6)	4	23
6.0	16	Rt	9"-25"	A-2-6 (0)	-	12
7.0	20	Rt	11.5"-23.5"	A-2-6 (1)	33	13
8.0	24	Lt	8"-18"	A-2-4 (0)	-	6
9.0	28	Lt	12"-28"	A-6 (2)	21	12
10.0	32	Lt	6.5"-46.5"	A-6 (7)	5	20
11.0	36	Lt	12"-44"	A-7-6 (12)	-	31
12.0	40	Rt	8"-44"	A-6 (11)	-	25
13.0	44	Rt	9"-49"	A-6 (5)	14	15
14.0	48	Lt	9"-32"	A-6 (2)	-	12
15.0	52	Lt	11"-46"	A-7-6 (20)	4	34
16.0	56	Lt	10"-46"	A-7-6 (17)	5	30
17.0	60	Rt	10"-48"	A-7-6 (10)	-	26
18.0	64	Rt	12"-46"	A-6 (5)	15	16
19.0	68	Lt	14"-36"	A-6 (3)	5	16
20.0	72	Lt				
21.0	76	Rt				
22.0	80	Lt				
23.0	84	Lt	1"-45"	A-2-6 (0)	35	12
24.0	88	Rt	1"-45"	A-2-6 (0)	35	12
25.0	92	Lt	6"-46"	A-6 (9)	15	18
26.0	96	Lt				

*Mileposts in this table may vary from actual field mileposts.

Since the R-Values for the subgrade material were so low, combinations of the base and HACP were tested to try and raise the SN and create a more stable and cost efficient structure. Four combinations were combined and tested for R-Values. The combinations consisted of 0% RAP and 100% base, 25% RAP and 75% base, 50% RAP and 50% base, and 75% RAP and 25% base. Table 3 below shows the R-Values for each of the combinations.

Table 3. R-Value combinations of RAP and base material.

Combination %RAP/ %Base	R-Value
0/100	75
25/75	80
50/50	84
75/25	79

Using the results from the field investigation on La Sal Mountain Loop Road, it was determined that a 6-inch pulverized base over the remaining base material with 3-inches of new HACP overlay would be the recommended pavement design. The average existing HACP and base course depth is 11-inches. The existing asphalt depth is an average of 1.5-inches thick with a minimum depth of 1-inch. The road is considered to be in moderately good condition for its age. Adding 3-inches of new HACP will almost double the existing pavement thickness and is assumed to be sufficient enough to account for areas of the roadway with less than 11-inches of HACP and base. Once again, it should be noted that about 9% of the existing roadway consists of less than 9-inches of existing HACP and base course. In some areas throughout the project, A-6 and A-7 soils exist and may be incapable of supporting traffic with a HACP and base course depth less than 11-inches. See Appendix A for these locations.

Note: cobbles are assumed to be present beneath the pavement. A visual survey of the surrounding foreslopes provides a good indicator of the subgrade make-up.

IV. PAVEMENT RECOMMENDATIONS & DISCUSSIONS

Two options are provided below. A pavement design was completed using 10, 15, and 20 year performance periods. The 15 year design had no change in cost from the 20 year design and was removed as a viable option. The first option provides a 20 year design with Full Depth Reclamation (FDR) – pulverization and new Hot Asphalt Concrete Pavement (HACP). The second option provides a double chip seal. Based on the current age and condition of the road, it is assumed that the double chip seal will last approximately 10 years.

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The required design Structural Number (SN) for the 20 year design is 2.45. The average existing HACP, existing base course, and existing HACP- base course combination thickness is 1.5-inches, 9.5-inches, and 11.0-inches respectively. The two design options are shown below.

20 Year Design: RECOMMENDED

3 inches HACP
6 inches FDR- Pulverization
3 inches Existing Base Course
SN = 2.52
Cost Estimate = \$286,816 per mile, paving cost only

10 Year Design:

Double Chip Seal
6 inches FDR – Pulverization
3 inches Existing Base Course
Cost Estimate = \$129,964 per mile, paving cost only

The recommended pavement rehabilitation is 6-inches of pulverized material on 3-inches of existing base course with 3-inches of new HACP. This 20 year design recommendation is based on traffic information, potential loadings, public access, existing pavement, subgrade, and soil conditions. This design rehabilitation method takes advantage of the existing HACP and base to construct a foundation for the new HACP. This method will result in a longer performance period.

Curb and gutter should be added on the cut slopes at the following areas:

- Milepost 12.6-13.3 Wet Area
- Milepost 21.1-23.1 Miners Basin

The curb and gutter is for drainage and should be constructed for a blade to be able to aid in roadway cleanup.

If budget constraints prohibit the use of the 20 year design, the double chip seal design should be considered. Localized failures may occur within a few years of completion of this project.

The complete cost estimation is in Appendix F. The recommendation and cost estimate is for mainline only and does not include ditches. Pavement depth may be less for pullouts and parking areas.

VII. MATERIALS RECOMMENDATIONS

Drainage, Subexcavation, and other Issues

During the field investigation of November 2010, there was no major water or drainage problems that were evident along La Sal Road; however in some areas snow, ice, and cold temperatures made it difficult to determine drainage issues. Due to the clayey subgrade

beneath La Sal Mountain Loop Road, it will be imperative that a prime coat be placed immediately onto the pulverized base material once that material is finished to grade. The prime coat will aid, along with proper grading, in shedding rainwater. If water is allowed to penetrate through unsealed base material, the subgrade will deteriorate and subexcavation may become necessary.

To prevent saturation of the subgrade soils and structural damage due to hauling on saturated soils, the 303 SCR will be modified to conform to the following limitations:

- Do not begin pulverization operations until the Superpave Pavement mix design has been submitted and approved by the CO.
- Pulverize the roadway in segments no greater than 2.5 lane miles at any time.
- Apply prime coat to the pulverized material within 5 work days of pulverization beginning.
- Apply the first lift of Superpave Pavement to the primed segment within 14 working days of beginning of pulverization.
- Construction equipment including hauling trucks will be required to travel as much as practical on paved sections and minimize the traffic loading on the pulverized material.

If subexcavation becomes necessary, follow the guidelines in the table below. The table is from Chapter 11 of the Project Development Design Manual (PDDM). Based on the soil classification testing it appears most of the subgrade would fall into the 2 foot depth category. To account for areas that may need to be subexcavated, 1000 cubic yards of subexcavation should be put in the contract to be used at the discretion of the CO.

Table 5. Subexcavation guidelines.

Plasticity Index (PI)	Liquid Limit (LL)	Depth of Subexcavation*
15 - 25	< 50	2 feet
25 - 35	50 - 60	2 - 4 feet
> 35	> 60	4 - 6 feet

* Traffic volume, project significance, and results of AASHTO T 258 and T 92 should influence subexcavation depth.

Selection of Asphalt Binder

LTTPBInd software indicates the use of PG 70-22 with a 98% reliability.

Pavement Materials

- 30300-0000 Pulverize, 6-inch depth.
- 40101-5600 – Superpave Pavement, $\frac{1}{2}$ -inch or $\frac{3}{4}$ -inch nominal maximum size aggregate, 0.3 to <3 million ESALs. Estimate at 145 lb/ft³. Asphalt binder will be PG 70-22. Type III Roughness to be specified.
- 40105-3000 - Antistrip will be Type III (Hydrated Lime at 1%).

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- 40910-0700 – Surface Treatment, Designation 2B (Chip Seal Alternative).
- 40920-1000 - Fog Seal, use an emulsified asphalt estimate at 0.10 gal/yd².
- 40940-1300 - Emulsified Asphalt, Grade CRS-2P, estimate at 0.98 gal/yd² (Chip Seal Alternative).
- 41101-3000 - Prime Coat, applied to the FDR-Pulverized material prior to paving. Use and emulsified asphalt estimate at 0.33 gal/yd².
- 41106-0000 - Item for blotter control should be included at 14.75 lb/ft².
- 41201-0000 - Tack Coat, HACP shall be placed in two lifts with a tack coat in between lifts. Use an emulsion CSS-1, CSS-1h, SS-1, or SS-1h, estimate at 0.10 gal/yd².

APPENDIX A

FIELD INVESTIGATION AND TESTING SUMMARIES

Partly cloudy, 40F, 8-10 mph winds
Start at MP 2.0 at Kens Lake Rd. looking toward higher mileposts

UT PFH 46-1(2) LA SAL MOUNTAIN LOOP ROAD

	Boring	Width ft(s)	Lane	Soil	Description	Note	AASHTO M.	ASTM D 2487	R-Value	P1	#200	#4	MC%	Photo #
La Sal Mountain Loop Road														
MP 2.25	1	21	Rt	0"-2" 2"-5"	HACP dark sand	Bag #1 accum.	61, 62, 63							
MP 2.5	2	21	Lt	0"-1.5" 1.5"-5.5"	HACP dark gravelly sand	Bag #1 accum. possible fill	64, 65, 66							
MP 2.75	3	21.5	Rt	0"-1.5" 1.5"-10.5"	HACP gravel base	Bag #1 accum.	67,68,69,70							
MP 3	4	21	Rt	0"-1.5" 1.5"-19.5" 19.5"-59.5"	HACP sandy gravel course gravel with brown fines	Bag #1 base Bag #1 subgrade Coordinates: N 38 27.6094° W 109 25.4144°	71, 72, 73							
MP 3.25	5	22.5	Lt	0"-2" 2"-12"	HACP gravelly sand	Bag #1 accum.	74,75,76							
MP 3.5	6	22	Rt	0"-1" 1"-12"	HACP medium brown gravelly sand	Bag #1 accum. telephone line 20' off left side of road	77,78,79							
MP 3.75	7	20.5	Lt	0"-1.5" 1.5"-11.5"	Light brown gravelly sand, less coarse	Bag #1 accum.	80, 81, 82							
MP 4	8	20	Rt	0"-2" 2"-16" 16"-38"	HACP medium brown sandy gravel light brown < gravelly sand	Bag #2 base Bag #2 subgrade Coordinates: N 38 27.7282° W 109 24.4941°	83, 84, 85, 86, 87	A-4 (1)	SC	10	42	92		
MP 4.25	9	20	Lt	0"-2" 2"-12"	HACP medium brown sandy gravel	Bag #1 accum.	88, 89, 90, 91							
MP 4.5	10	23	Rt	0"-2" 2"-12"	HACP medium brown < gravelly sand	Bag #1 accum.	92, 93, 94							
MP 4.75	11	20	Lt	0"-3" 3"-12"	HACP dark brown < gravelly sand	Bag #1 accum.	95, 96, 97							
MP 5	12	20.5	Rt	0"-3" 3"-7" 7"-55"	HACP medium brown < gravelly sand light brown < gravelly sand	Bag #3 base Bag #3 subgrade Coordinates: N 38 26.9388° W 109 23.5142°	98, 99, 100, 101, 102	A-6 (6)	SC	4	23	48	88	
MP 5.25	13	19.5	Lt	0"-1.5" 1.5"-11.5"	HACP medium brown sandy gravel	Bag #2 accum. telephone line 20' off of lt. side of road	103, 104, 105							
MP 5.5	14	27.5	Rt	0"-1" 1"-12"	HACP medium brown sandy gravel	Bag #2 accum.	106, 107, 108							
MP 5.75	15	27	Lt	<1" 1"-11"	HACP medium brown sandy gravel	Bag #2 accum. possible fill	109, 110, 111							
MP 6	16	28	Rt	0"-1" 1"-9" 9"-25"	HACP medium brown sandy gravel light brown gravelly sand refusal at 25", large cobble, see photo 1.5	Bag #4 base Bag #4 subgrade Coordinates: N 38 26.9527° W 109 22.4819°	112, 113, 114, 115	A-2-6 (0)	SC	12	28	77		
MP 6.25	17	27	Lt	0"-1.5" 1.5"-11.5"	HACP medium brown sandy gravel	Bag #2 accum.	116, 117, 118							
MP 6.5	18	25	Rt	0"-1" 1"-11"	HACP medium brown sandy gravel	Bag #2 accum.	119, 120, 121							

MP 6.75	19	28	Lt	0"-1" 1"-11"	HACP medium brown sandy gravel	Bag #2 accum.	122, 123, 124
MP 7	20	27	Rt	0"-1.5" 1.5"-11.5" 11.5"-23.5"	HACP medium brown sandy gravel light brown gravelly sand refusal at 24", see photo 128	Bag #5 base Bag #5 subgrade Coordinates: N 38 27.3131; W 109 22.5411'	125, 126, 127, 128, 129 A-2-6 (1)
MP 7.25	21	27	Lt	<1" 1"-11"	HACP medium brown sandy gravel	Bag #2 accum.	130, 131
MP 7.5	22	26.5	Rt	<1" 1"-11"	HACP medium brown sandy gravel	Bag #2 accum.	132, 133
MP 7.75	23	23	Lt	0"-5" 5"-10"	HACP dark brown sandy gravel	Bag #2 accum. possible fill	134, 135, 136
MP 8	24	26.5	Lt	0"-2" 2"-8" 8"-18"	HACP medium brown sandy gravel light brown gravelly sand refusal at 15", see photo 140	Bag #6 base Bag #6 subgrade Coordinates: N 38 27.9083; W 109 21.9147'	137, 138, 139, 140 A-2-4 (0)
MP 8.25	25	26.5	Lt	0"-1.5" 1.5"-11.5"	HACP medium brown sandy gravel	Bag #2 accum.	141, 142, 143
MP 8.5	26	27	Rt	0"-2" 2"-12"	HACP medium brown sandy gravel	Bag #2 accum.	144, 145
MP 8.75	27	26.5	Rt	0"-1.5" 1.5"-11.5"	HACP medium brown sandy gravel, coarser	Bag #2 accum.	146, 147, 148
MP 9	28	26.5	Lt	0"-1" 1"-12" 12"-38"	HACP medium brown sandy gravel red brown sandy gravel refusal at 28"	Bag #7 base Bag #7 subgrade Coordinates: N 38 28.3042; W 109 21.1506'	149, 150, 151, 152 A-6 (2)
MP 9.25	29	26	Rt	0"-1.5" 1.5"-11.5"	HACP medium brown gravelly sand	Bag #2 accum.	154, 155, 156
MP 9.5	30	25	Rt	0"-1" 1"-11"	HACP dark brown sandy gravel	Bag #2 accum.	157, 158
MP 9.75	31	25	Rt	0"-1.5" 1.5"-10.5"	HACP medium brown sandy gravel		159, 160, 161
MP 10	32	26.5	Lt	0"-1.5" 1.5"-6.5" 6.5"-46.5"	HACP medium brown sandy gravel light brown sandy clay	Bag #8 base Bag #8 subgrade Coordinates: N 38 28.6072; W 109 20.6087'	162, 163, 164, 165 A-6 (7)
MP 10.25	33	26	Rt	0"-2" 2"-12"	HACP medium brown sandy gravel		166, 167, 168
MP 10.5	34	24.5	Lt	0"-2" 2"-12"	HACP medium brown sandy gravel		169, 170
MP 10.75	35	23	Rt	0"-2" 2"-12"	HACP dark brown gravel		171, 172, 173
MP 11	36	26	Lt	0"-7" 7"-12" 12"-44"	HACP medium brown sandy gravel medium brown sandy clay	Bag #9 base Bag #9 subgrade Coordinates: N 38 28.9643; W 109 19.9423'	174, 175, 176 A-7-6 (12)
MP 11.25	37	24	Rt	<1" 1"-11"	HACP medium brown sandy gravel		178, 179 CL 31, 52, 73

MP 11.5	38	26	Lt	0"-1" 1"-11"	HACP	medium brown sandy gravel	180, 181, 182, 183
MP 11.75	39	24	Lt	0"-3" 3"-12"	HACP	medium brown sandy gravel	184, 185, 186
MP 12	40	26	Rt	0"-3" 3"-8" 8"-44"	HACP	medium brown gravelly red brown sandy clay	Bag #10 base Bag #10 subgrade Coordinates: N 38 29.1865' W 109 19.0863'
MP 12.25	41	23.5	Lt	0"-2" 2"-12"	HACP	medium brown sandy gravel	191, 192
MP 12.5	42	23	Rt	0"-1.5" 1.5"-11.5"	HACP	medium brown sandy gravel	193, 194, 195
MP 12.75	43	27.5	Lt	0"-1.5" 1.5"-11.5"	HACP	medium brown sandy gravel	197, 198, 199
MP 13	44	18	Rt	0"-2" 2"-9" 9"-49"	HACP	medium brown gravelly sand red brown sandy clay	Coordinates: N 38 29.6122' W 109 19.6446' Bag #11 base Bag #11 subgrade Coordinates: N 38 29.6122' W 109 19.6446'
MP 13.25	45	20	Lt	0"-1" 1"-11"	HACP	dark brown gravelly sand	tearing in left lane, see photo 210 207, 208, 209, 210
MP 13.5	46	26.5	Rt	0"-3" 3"-11"	HACP	light brown gravelly sand	212, 213, 214
MP 13.75	47	22	Rt	0"-1.5" 1.5"-11.5"	HACP	medium brown gravelly sand	215, 217, 218
MP 14	48	21.5	Lt	0"-2" 2"-9" 9"-32"	HACP	medium brown gravelly sand red brown sandy clay refusal at 32"	culvert (can only see outlet on lt side) Bag #12 base Coordinates: N 38 29.8095' W 109 19.8227'
MP 14.25	49	21	Rt	0"-2" 2"-12"	HACP	medium brown sandy gravel	223, 224, 225
MP 14.5	50	21.5	Lt	0"-1" 1"-12"	HACP	medium brown gravelly sand	226, 227, 228
MP 14.75	51	21	Rt	0"-1" 1"-12"	HACP	medium brown sandy gravel	229, 230, 231
MP 15	52	19	Lt	0"-2" 2"-11" 11"-46"	HACP	medium brown gravelly sand dark brown sandy heavy clay	Coordinates: N 38 29.9686' W 109 19.6405' Bag #13 base Bag #13 subgrade
MP 15.25	53	20	Rt	0"-1" 1"-12"	HACP	dark brown gravelly sand	236, 237, 238
MP 15.5	54	21.5	Lt	0"-1" 1"-12"	HACP	dark brown gravelly sand	239, 240, 241
MP 15.75	55	24	Rt	<1" 1"-11"	HACP	medium brown gravelly sand	242, 245, 244
MP 16	56	22	Lt	0"-1" 1"-10" 10"-45"	HACP	medium brown gravelly sand dark brown sandy clay	Coordinates: N 38 30.4450' W 109 20.3154' Bag #14 base Bag #14 subgrade
MP 16.25	57	24	Lt	0"-1"	HACP		250, 251, 252

MP 16.5	58	22.5	Rt	0"-1" 1"-12"	1"-12"	medium brown sandy gravel!					
MP 16.75	59	21.5	Lt	<1" 1"-12"	HACP	medium brown gravelly sand					253, 254, 255
MP 17	60	21.5	Rt	0"-3" 3"-10" 10"-48"	HACP	medium brown gravelly sand					
MP 17.25	61	23	Lt	0"-1" 1"-12"	HACP	medium brown gravelly sand					
MP 17.5	62	22.5	Rt	<1" 1"-12"	HACP	medium brown gravelly sand					269, 270, 271
MP 17.75	63	20	Lt	<1" 1"-12"	HACP	medium brown gravelly sand					272, 273, 274
MP 18	64	21	Rt	0"-1" 1"-12" 12"-46"	HACP	medium brown gravelly sand					
MP 18.25	65	23	Lt	0"-1" 1"-12"	HACP	light brown gravelly sand					279, 280, 281
MP 18.5	66	20.5	Rt	0"-1" 1"-12"	HACP	medium brown sandy gravel!					282, 283, 284
MP 18.75	67	24	Lt	0"-2" 2"-12"	HACP	dark brown gravelly sand					285, 286, 287
MP 19	68	23	Lt	0"-1" 1"-14" 14"-36"	HACP	dark brown gravelly sand					288, 289, 290, 291
MP 19.25	69	22.5	Rt	<1" 1"-11"	HACP	medium brown sandy gravel!					292, 293, 294
MP 19.5	70	22.5	Lt	0"-2" 2"-12"	HACP	medium brown gravelly sand					295, 296, 297
MP 19.75	71	20.5	Rt	<1" 1"-12"	HACP	dark brown gravelly sand					298, 299, 300
MP 20	72	23	Lt	0"-1" 1"-11" 11"-45"	HACP	medium brown gravelly sand	No recovery				301, 302, 303, 304
MP 20.25	73	22.5	Rt	<1" 1"-11"	HACP	dark brown gravelly sand	No recovery				305, 306, 307
MP 20.5	74	24.5	Rt	0"-1" 1"-11"	HACP	very dark brown gravelly sand					308, 309
MP 20.75	75	21.5	Lt	<1" 1"-13"	HACP	dark brown gravelly sand					310, 311, 312
MP 21	76	20	Rt	0"-1" 1"-11" 11"-25"	HACP	medium brown gravelly sand	Bag #18 base				313, 314, 315, 316
						medium brown sandy gravel	Bag #18 subgrade				Coordinates: N 38 32.7776' W 109 17.6905'

MP 21.25	77	22	Lt	0"-1" 1"-11"	HACP	medium brown gravelly sand		317, 318, 319
MP 21.5	78	21	Rt	0"-2" 2"-10"	HACP	medium brown gravelly sand w/ cobbles [borrow]		320, 321, 322, 323
MP 21.75	79	20	Lt	0"-1.5" 1.5"-11.5"	HACP	medium brown gravelly sand [borrow]		324, 325, 326
MP 22	80	20	Lt	<1" 1"-3.5"	HACP	medium brown sandy gravel w/ cobbles [borrow]	No recovery No recovery	327, 328
						Coordinates: N 35 33.3652' W 109 17.3165'		
MP 22.25	81	19	Rt	0"-1" 1"-12"	HACP	medium brown sandy gravel with cobbles [borrow]		329, 330, 331
MP 22.5	82	20.5	Lt	0"-1" 1"-15"	HACP	medium brown gravelly sand		332, 333, 334, 335
MP 22.75	83	17	Rt	<1" 1"-13"	HACP	medium brown gravelly sand		336, 337, 338
MP 23	84	18	Lt	0"-1" 1"-4.5"	HACP	no base medium brown sandy gravel w/ cobbles [borrow]	no recovery Bag # 19	339, 340, 341 A-2-6(0) GC 35 12 23 60
						Coordinates: N 38 34.1731' W 109 17.6983'		
MP 23.25	85	24	Rt	0"-3" 3"-13"	HACP	medium brown gravelly sand with some PI		342, 343, 344
MP 23.5	86	24	Lt	0"-1.5" 1.5"-13.5"	HACP	medium brown gravelly sand		345, 346, 347
MP 23.75	87	22	Rt	0"-2" 2"-12"	HACP	medium brown gravelly sand		348, 349
MP 24	88	19	Rt	0"-2" 2"-12"	HACP	no base medium brown sandy gravel [borrow]	no recovery Bag #19	350, 351, 352 A-2-6(0) GC 35 12 23 60
						Coordinates: N 38 34.6349' W 109 17.5386'		
MP 24.25	89	20	Lt	0"-2" 2"-18"	HACP	medium brown sandy clay	collected rocks on slope [photo 356]	353, 354, 355, 356
MP 24.5	90	20	Lt	0"-1" 1"-17"	HACP	medium brown gravel sand [borrow]	culvert parallel to road under cross road on its side	357, 358, 359
MP 24.75	91	17	Rt	0"-1" 1"-11"	HACP	medium brown gravelly sand	collected rocks on slope [photo 360] tearing in its lane (photo 364)	360, 361, 362, 363, 364
MP 25	92	18	Lt	0"-2" 2"-6" 6"-46"	HACP	dark brown gravelly sand red brown gravelly sand	Bag #19 base Bag #20 subgrade	365, 366, 367, 368 A-6(9) CL 15 18 65 98
						Coordinates: N 38 35.2522' W 109 17.4948'		
MP 25.25	93	19	Rt	0"-1" 1"-11"	HACP	medium brown sandy gravel [borrow]		369, 370, 371
MP 25.5	94	18	Lt	<1" 1"-13"	HACP	medium brown sand		372, 373, 374
MP 25.75	95	19	Rt	0"-1" 1"-11"	HACP	medium brown sand		375, 376, 377
MP 26	96	23.5	Lt	0"-1"	HACP			378, 379

APPENDIX B

LABORATORY TEST RESULTS



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Central Federal Lands Highway Division Laboratory

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Report of Soil or Aggregate Tests

Page 1 of 8

Project: Utah PFH 46-1(2) La Sal Mountain

Submitted By: Danielle Germani

Date Reported: 2/7/2011

Sample Number	Lab Number	11-22-RV	11-23-RV	11-24-S	11-25-RV	11-26-S
Sample Location	Milepost	4.0	5.0	6.0	7.0	8.0
	Offset	Right	Right	Right	Right	Left
	Depth	16"-58"	7"-55"	9"-25"	11.5"-23.5"	8"-18"
AASHTO T 11, T 27 & T 88	3"	75.0 mm				
	1 1/2"	37.5 mm				
	1"	25.0 mm	100			100
	3/4"	19.0 mm	99	100	100	99
	1/2"	12.5 mm	98	98	96	94
	3/8"	9.5 mm	96	96	92	90
	#4	4.75 mm	92	88	77	76
	#8	2.36 mm				
	#10	2.00 mm	87	81	66	66
	#16	1.18 mm	85	78	62	60
	#30	600 µm				
	#40	425 µm	79	73	56	52
	#50	300 µm				
	#100	150 µm	59	59	39	41
	#200	75 µm	42	48	28	33
	20 µm					
	2 µm					
	1 µm					
AASHTO T 255	Moisture, %					
AASHTO T 89 & T 90	Liquid Limit	20	33	21	26	18
	Plasticity Index	10	23	12	13	6
Soil Classification	AASHTO M 145	A-4 (1)	A-6 (6)	A-2-6 (0)	A-2-6 (1)	A-2-4 (0)
	ASTM D 2487	SC	SC	SC	SC	SC-SM
AASHTO T 190	R - Value	41	4		33	
AASHTO T 288	Min. Resistivity, ohm x cm		1130			
AASHTO T 289	pH		7.1			
AASHTO T 290	Sulfate Ion Content, %/ppm		0.0152 / 152			
AASHTO T 291	Chloride Ion Content, %/ppm		0.014 / 140			

Distribution: Num. / Project File
 Laboratory Darrel Harding
 Pavements Danielle Germani
 Pavements Steve Deppmeier
 Materials Mike Peabody

Remarks: Sulfate & chloride content testing was performed by FHWA consultant, Colorado Analytical Laboratories.

Reported By:

Darrell Harding
Laboratory Manager



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Page 2 of 8

Project: Utah PFH 46-1(2) La Sal Mountain

Submitted By: Danielle Germani

Date Reported: 2/7/2011

Sample Number	Lab Number	11-27-RV	11-28-RV	11-29-S	11-30-S	11-31-RV
Sample Location	Milepost	9.0	10.0	11.0	12.0	13.0
	Offset	Left	Left	Left	Right	Right
	Depth	12"-28"	6.5"-46.5"	12"-44"	8"-44"	9"-49"
AASHTO T 11, T 27 & T 88	3"	75.0 mm				
	1 1/2"	37.5 mm				
	1"	25.0 mm	100		100	
	3/4"	19.0 mm	98	100	99	100
	1/2"	12.5 mm	93	96	97	98
	3/8"	9.5 mm	91	93	96	98
	#4	4.75 mm	84	85	73	90
	#8	2.36 mm				
	#10	2.00 mm	80	81	68	86
	#16	1.18 mm	77	79	66	84
	#30	600 µm				
	#40	425 µm	74	75	63	80
	#50	300 µm				
	#100	150 µm	64	66	58	71
	#200	75 µm	46	56	52	59
Washed Sieve Analysis % Passing	20 µm					
	2 µm					
	1 µm					
AASHTO T 255	Moisture, %					
AASHTO T 89 & T 90	Liquid Limit	24	32	45	38	27
	Plasticity Index	12	20	31	25	15
Soil Classification	AASHTO M 145	A-6 (2)	A-6 (7)	A-7-6 (12)	A-6 (11)	A-6 (5)
	ASTM D 2487	SC	CL	CL	CL	CL
AASHTO T 190	R - Value	21	5			14
AASHTO T 288	Min. Resistivity, ohm x cm			1130		
AASHTO T 289	pH			7.7		
AASHTO T 290	Sulfate Ion Content, %/ppm			0.0139 / 139		
AASHTO T 291	Chloride Ion Content, %/ppm			0.005 / 50		

Distribution: Num. / Project File
 Laboratory Darrell Harding
 Pavements Danielle Germani
 Pavements Steve Deppmeier
 Materials Mike Peabody

Remarks: Sulfate & chloride content testing was performed by FHWA consultant, Colorado Analytical Laboratories.

Reported By:

Darrell Harding
Laboratory Manager



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Report of Soil or Aggregate Tests

Page 3 of 8

Project: Utah PFH 46-1(2) La Sal Mountain

Submitted By: Danielle Germani

Date Reported: 2/7/2011

Sample Number	Lab Number	11-32-S	11-33-RV	11-34-RV	11-35-S	11-36-RV
Sample Location	Milepost	14.0	15.0	16.0	17.0	18.0
	Offset	Left	Left	Left	Right	Right
	Depth	9"-32"	11"-46"	10"-46"	10"-48"	12"-46"
AASHTO T 11, T 27 & T 88	3"	75.0 mm				
	1 1/2"	37.5 mm				
	1"	25.0 mm	100	100		
	3/4"	19.0 mm	99	99	100	100
	1/2"	12.5 mm	95	98	99	99
	3/8"	9.5 mm	92	96	97	97
	#4	4.75 mm	84	91	94	92
	#8	2.36 mm				
	#10	2.00 mm	75	86	91	88
	#16	1.18 mm	70	84	88	86
	#30	600 µm				
	#40	425 µm	64	79	84	82
	#50	300 µm				
	#100	150 µm	53	73	75	74
	#200	75 µm	43	66	66	54
Washed Sieve Analysis % Passing	20 µm					
	2 µm					
	1 µm					
AASHTO T 255	Moisture, %					
AASHTO T 89 & T 90	Liquid Limit	24	50	42	43	27
	Plasticity Index	12	34	30	26	16
Soil Classification	AASHTO M 145	A-6 (2)	A-7-6 (20)	A-7-6 (17)	A-7-6 (10)	A-6 (5)
	ASTM D 2487	SC	CH	CL	CL	CL
AASHTO T 190	R - Value		4	<5		15
AASHTO T 288	Min. Resistivity, ohm x cm				1460	
AASHTO T 289	pH				7.1	
AASHTO T 290	Sulfate Ion Content, %/ppm				0.0196 / 196	
AASHTO T 291	Chloride Ion Content, %/ppm				0.002 / 20	

Distribution:
 Laboratory Darrell Harding
 Pavements Danielle Germani
 Pavements Steve Deppmeier
 Materials Mike Peabody

Remarks: Sulfate & chloride content testing was performed by FHWA consultant, Colorado Analytical Laboratories.

Reported By:

Darrell Harding
Laboratory Manager



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Report of Soil or Aggregate Tests

Page 4 of 8

Project: Utah PFH 46-1(2) La Sal Mountain

Submitted By: Danielle Germani

Date Reported: 2/7/2011

Sample Number	Lab Number	11-37-RV	11-38-RV	11-39-RV		
	Hole Number	B68	B84/B88	B92		
	Field Number	Subgrade #17	Subgrade #19	Subgrade #20		
Sample Location	Milepost	19.0	23.0/24.0	25.0		
	Offset	Left	Left/Right	Left		
	Depth	14"-36"	1"-45"	6"-46"		
AASHTO T 11, T 27 & T 88 Washed Sieve Analysis % Passing	3"	75.0 mm		100		
	1 1/2"	37.5 mm		88		
	1"	25.0 mm		83		
	3/4"	19.0 mm	100	80		
	1/2"	12.5 mm	97	75	100	
	3/8"	9.5 mm	94	71	99	
	#4	4.75 mm	87	60	98	
	#8	2.36 mm				
	#10	2.00 mm	81	50	96	
	#16	1.18 mm	79	45	94	
	#30	600 µm				
	#40	425 µm	75	35	89	
	#50	300 µm				
	#100	150 µm	58	28	84	
	#200	75 µm	42	23	65	
		20 µm				
		2 µm				
		1 µm				
AASHTO T 255	Moisture, %					
AASHTO T 89 & T 90	Liquid Limit	26	26	30		
	Plasticity Index	16	12	18		
Soil Classification	AASHTO M 145	A-6 (3)	A-2-6 (0)	A-6-(9)		
	ASTM D 2487	SC	GC	CL		
AASHTO T 190	R – Value	5	35	15		
AASHTO T 288	Min. Resistivity, ohm x cm			1000		
AASHTO T 289	pH			7.5		
AASHTO T 290	Sulfate Ion Content, %/ppm			0.0031 / 31		
AASHTO T 291	Chloride Ion Content, %/ppm			0.006 / 60		

Distribution: Num. / Project File
 Laboratory Darrell Harding
 Pavements Danielle Germani
 Pavements Steve Deppmeier
 Materials Mike Peabody

Remarks: Sulfate & chloride content testing was performed by FHWA consultant, Colorado Analytical Laboratories.

Reported By:

Darrell Harding
Laboratory Manager



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Report of Soil or Aggregate Tests

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Project: Utah PFH 46-1(2) La Sal Mountain

Submitted By: Danielle Germani

Date Reported: 2/7/2011

Sample Number	Lab Number	11-40-AGG	11-41-AGG	11-42-AGG	11-43-AGG	
	Hole Number	B4 B16	B40, B44 B48	B60 B64	B76 B92	Four Samples Combined
	Field Number	Base #2 Base #4	Base #10 Base #11 Base #12	Base #15 Base #16	Base #18 Base #19	
Sample Location	Milepost And Offset	3.0 Right 6.0 Right	12.0 Right 13.0 Right 14.0 Left	17.0 Right 18.0 Right	21.0 Right 25.0 Left	
	Depth	1.5"-19.5" 1"-9"	3"-8" 2"-9" 2"-9"	3"-10" 1"-12"	1"-11" 2"-6"	
AASHTO T 11, T 27 & T 88 Washed Sieve Analysis % Passing	1 1/2"	37.5 mm			100	
	1"	25.0 mm	100	100	99	100
	3/4"	19.0 mm	98	98	97	98
	1/2"	12.5 mm	86	87	81	93
	3/8"	9.5 mm	77	76	68	88
	#4	4.75 mm	63	55	46	73
	#8	2.36 mm	56	45	36	62
	#10	2.00 mm	54	42	34	60
	#30	600 µm	47	31	24	47
	#40	425 µm	45	28	21	43
	#50	300 µm	42	25	19	40
	#200	75 µm	23	14	11	23
		20 µm				
		2 µm				
		1 µm				
AASHTO T 255	Moisture, %					
AASHTO T 89 & T 90	Liquid Limit	18	NV	NV	NV	18
	Plasticity Index	4	NP	NP	NP	1
Soil Classification	AASHTO M 145	A-1-b (0)	A-1-a (0)	A-1-a (0)	A-1-b (0)	A-1-b (0)
	ASTM D 2487	SC-SM	GM	GP-GM	SM	SM
AASHTO T 190	R – Value	63	79	88	72	
AASHTO T 288	Min. Resistivity, ohm x cm					
AASHTO T 289	pH					
AASHTO Method	Optimum Moisture, %					
	Maximum Dry Density, pcf					

Distribution: Num. / Project File
 Laboratory Darrell Harding
 Pavements Danielle Germani
 Pavements Steve Deppmeier
 Materials Mike Peabody

Remarks: The combined base course gradation is a mathematical blend of the four base samples.

The liquid limit and plasticity index are from testing the actual blend.

Reported By:

Darrell Harding
 Laboratory Manager



Central Federal Lands Highway Division Laboratory

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Report of Asphalt Concrete Mixture Tests

Project: Utah PFH 46-1(2) La Sal Mountain

Lab Number		Field Number		Sample Location		Submitted By: Danielle Germani				Date Reported: 2/7/2011
				La Sal Mountain Road		11-44-AGG HACP #1		11-45-AGG HACP #2		HACP #1 & #2 Combined
Item:	Class:	Sieve Size	Gr. , Spec.	T.V.	(D)					
		1"	25.0 mm							
AASHTO T 30	3/4"	19.0 mm				100		100		100
	1/2"	12.5 mm				94		96		95
	3/8"	9.5 mm				82		90		86
	#4	4.75 mm				57		59		58
	#8	2.36 mm				42		43		43
Sieve Analysis, % Passing	#10	2.00 mm								
	#16	1.18 mm								
	#30	600 μ m				30		29		30
	#40	425 μ m				28		27		28
	#50	300 μ m				25		24		25
	#100	150 μ m								
	#200	75 μ m								
AASHTO T 308 Asphalt Content, % by Total Mix Weight						9.6		9.1		9.4
	Density,pcf									
Field Cores	Absorption, %									
	Density,pcf									
	Compaction, %									
	Thickness, inches									
	Moisture Induced Damage	Conditioned Strength, psi								
Loose Asphalt Mixture Received From Field	AASHTO T 283	Dry Strength, psi								
	Maximum Density, pcft	Tensile Strength Ratio, %								
	Hveem Specimen AASHTO T 246	Air Voids, %								
		AASHTO T 209								
		Stabilometer value								
		Density,pcf								
		Air Voids, %								

Distribution:
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Materials

Num. / Project File
Darrell Harding
Danielle Germani
Steve Deppmeier
Mike Peabody

Remarks: This material is existing HACP with chip seal.

The combined RAP gradation and asphalt content are mathematical blends of the two existing HACP samples.

"ID" indicates the allowable deviation from the target value.

Reported By:

Darrell Harding
Laboratory Manager

Danielle Germani
ASHTO R18 ISOC E702



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Date Reported: 2/7/2011

Page 7 of 8

Project: Utah PFH 46-1(2) La Sal Mountain

Submitted By: Danielle Germani

Sample Number	Lab Number	Combined	Combined	Combined	Combined
	Hole Number				
	% RAP / % Base	0 / 100	25 / 75	50 / 50	75 / 25
Sample Location	Milepost				
	Offset				
	Depth				
AASHTO T 11, T 27 & T 88	3"	75.0 mm			
	1 1/2"	37.5 mm			
	1"	25.0 mm	100	100	100
	3/4"	19.0 mm	98	99	99
	1/2"	12.5 mm	87	89	91
	3/8"	9.5 mm	77	79	82
	#4	4.75 mm	59	59	59
	#8	2.36 mm	50	48	47
	#10	2.00 mm			
	#16	1.18 mm			
	#30	600 µm	37	35	34
	#40	425 µm	34	33	31
	#50	300 µm	32	30	29
	#100	150 µm			
	#200	75 µm	18	16	14
Washed Sieve Analysis % Passing		20 µm			
		2 µm			
		1 µm			
AASHTO T 255	Moisture, %				
AASHTO T 89 & T 90	Liquid Limit				
	Plasticity Index				
Soil Classification	AASHTO M 145				
	ASTM D 2487				
AASHTO T 190	R – Value	75	80	84	79
AASHTO T 288	Min. Resistivity, ohm x cm				
AASHTO T 289	pH				
AASHTO Method	Optimum Moisture, %				
	Maximum Dry Density,pcf				

Distribution:
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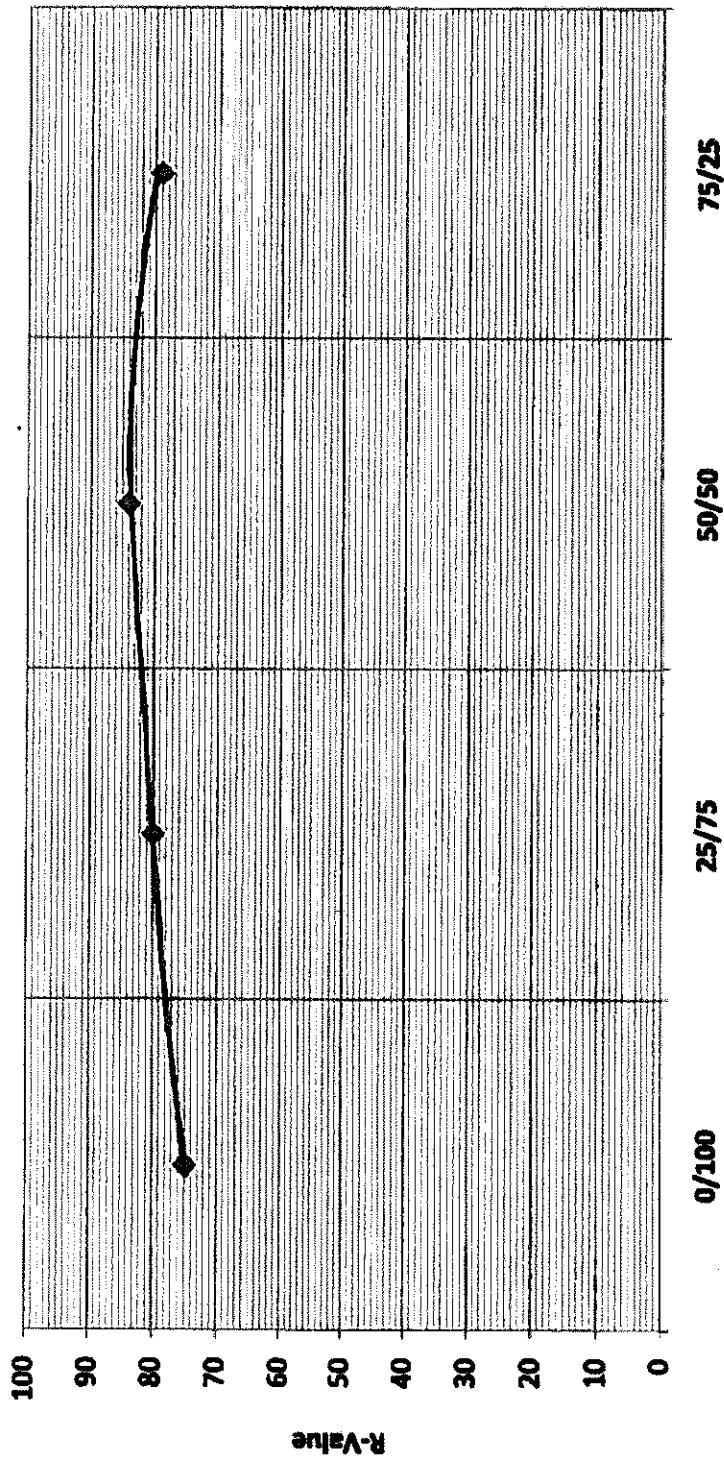
Num. / Project File
Darrell Harding
Danielle Germani
Steve Deppmeier
Mike Peabody

Remarks: This material is a blend of existing pavement
and aggregate base.

Reported By:

Darrell Harding
Laboratory Manager

**R-Value Graph for Utah PFH 46-1 (2) La Sal Mountain
Various RAP-Base Ratios
(11-40-43-AGG)**

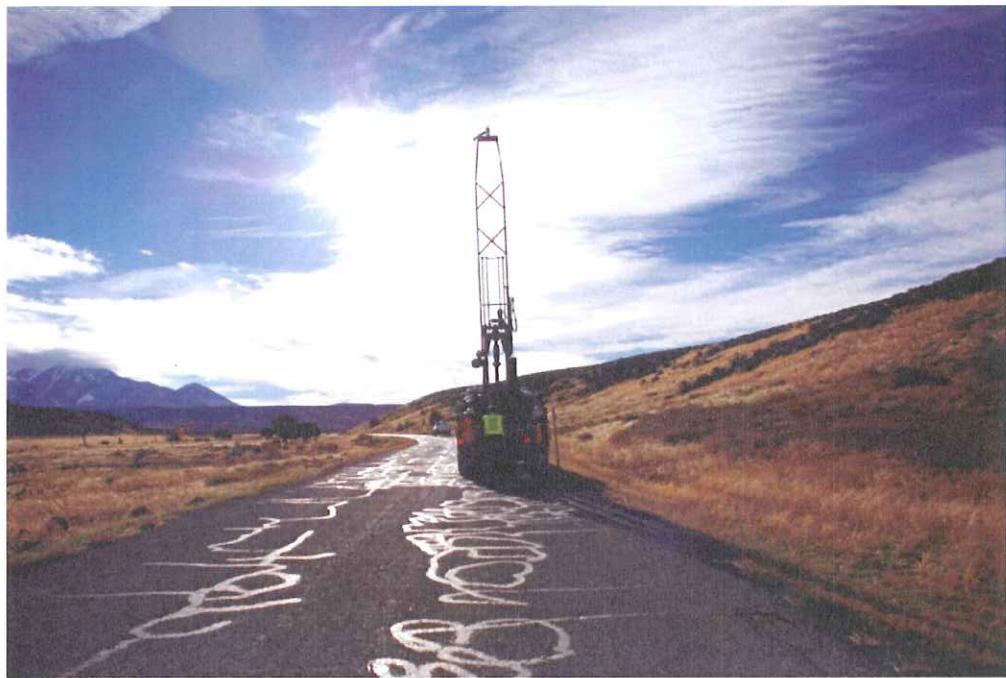


APPENDIX C

PHOTOGRAPHS

LA SAL MOUNTAIN LOOP ROAD

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 2.75 Rt. La Sal Mountain Loop Road, B-3, Looking North



MP 3.0 Rt. La Sal Mountain Loop Road, B-4, Subgrade material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 4.0 Rt. La Sal Mountain Loop Road, B-8, Base material



MP 4.0 Rt. La Sal Mountain Loop Road, B-8, Subgrade material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 5.0 Rt. La Sal Mountain Loop Road, B-12, Subgrade material



MP 6.0 Rt. La Sal Mountain Loop Road, B-16, Slope

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD

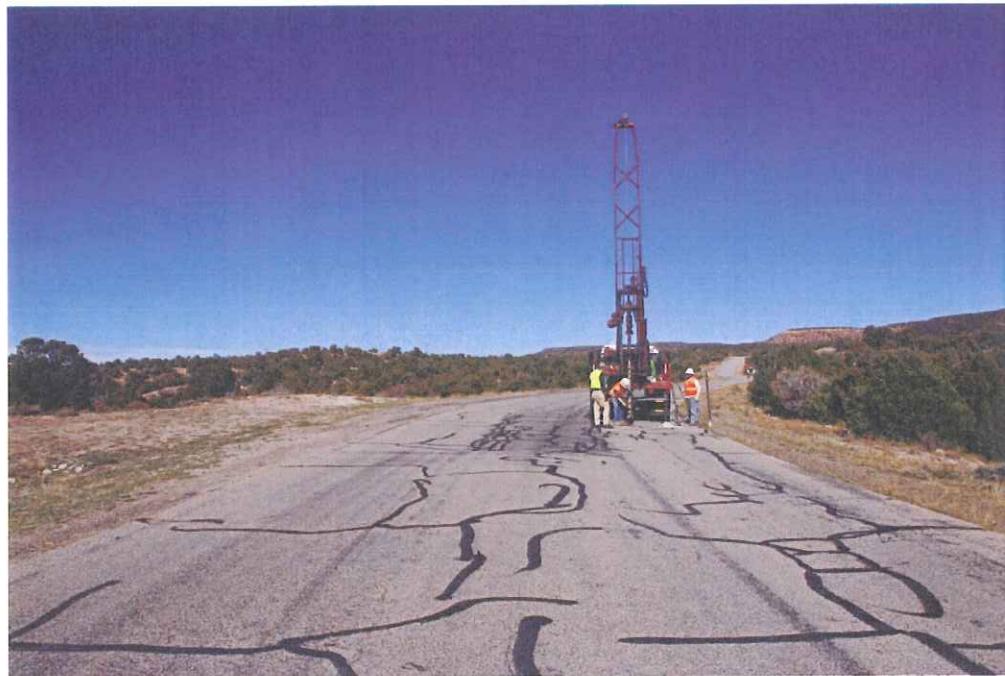


MP 7.0 Lt. La Sal Mountain Loop Road, B-20, Base material



MP 7.0 Lt. La Sal Mountain Loop Road, B-20 Subgrade material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 8.0 Lt. La Sal Mountain Loop Road, B-24, Looking north



MP 9.0 Lt. La Sal Mountain Loop Road, B-28, Subgrade material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD

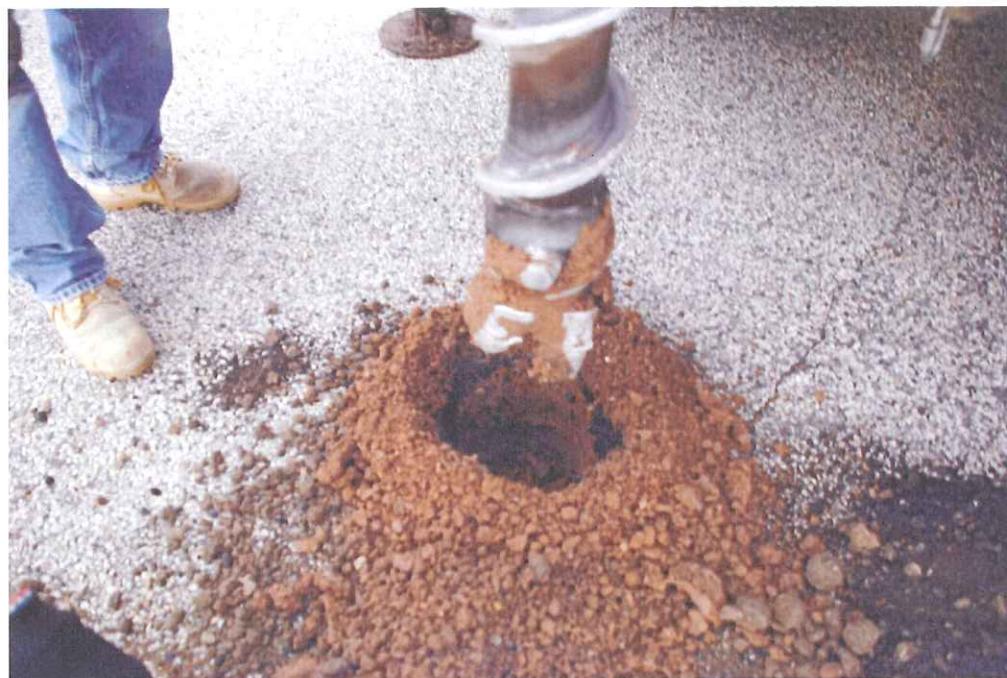


MP 10.0 Lt. La Sal Mountain Loop Road, B-32, Base material

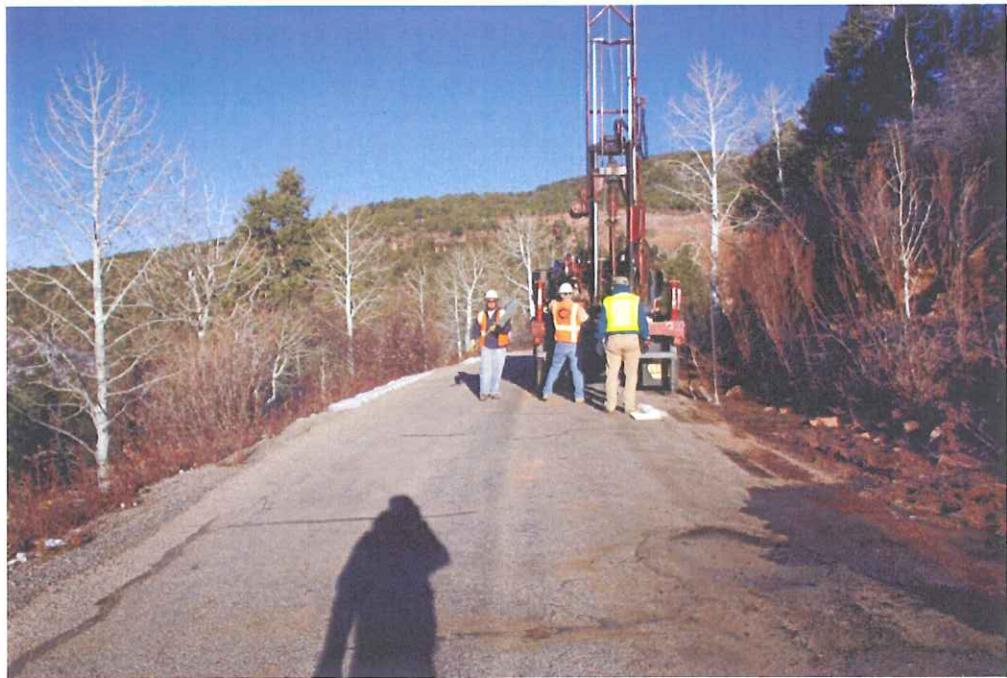


MP 11.0 Lt. La Sal Mountain Loop Road, B-36, Looking north

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 12.0 Rt. La Sal Mountain Loop Road, B-40, Subgrade material



MP 13.0 Rt. La Sal Mountain Loop Road, B-44, Looking north

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD

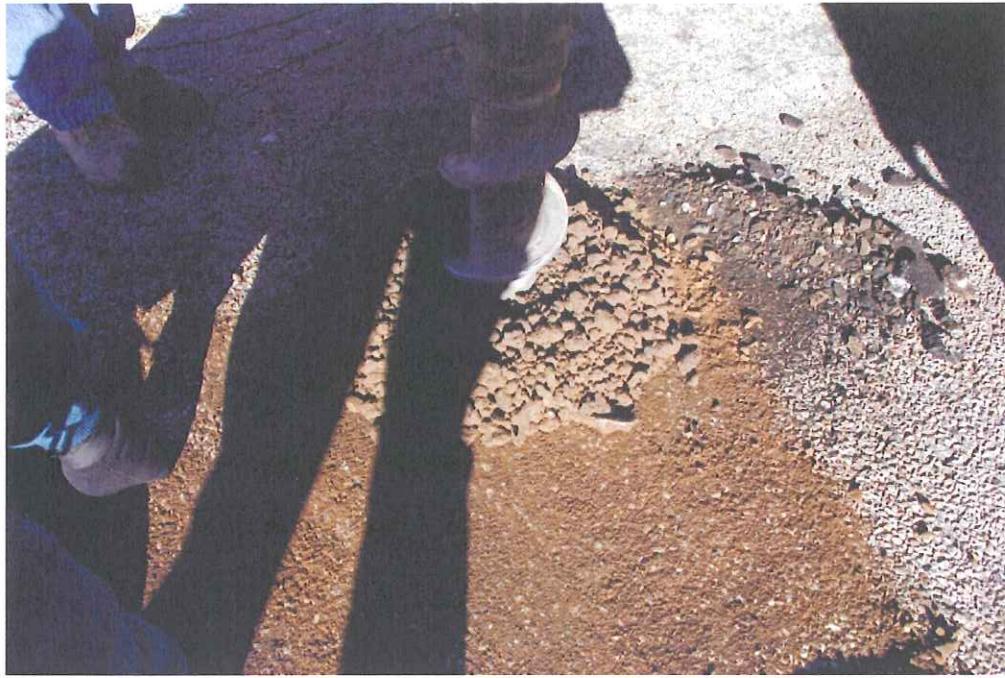


MP 13.0 Rt. La Sal Mountain Loop Road, B-44, Subgrade material



MP 14.0 Lt. La Sal Mountain Loop Road, B-48, Base material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 15.0 Lt. La Sal Mountain Loop Road, B-52, Subgrade material



MP 16.0 Lt. La Sal Mountain Loop Road, B-56, Subgrade material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 17.0 Rt. La Sal Mountain Loop Road, B-60, Looking north



MP 17.0 Rt. La Sal Mountain Loop Road, B-60, Base material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 18.0 Rt. La Sal Mountain Loop Road, B-64, Base material



MP 18.0 Rt. La Sal Mountain Loop Road, B-64, Subgrade material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 19.0 Lt. La Sal Mountain Loop Road, B-68, Base material



MP 20.0 Lt. La Sal Mountain Loop Road, B-72, Base material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 20.0 Lt. La Sal Mountain Loop Road, B-72, Subgrade material



MP 21.0 Rt. La Sal Mountain Loop Road, B-76, Subgrade material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 22.0 Lt. La Sal Mountain Loop Road, B-80, Base material



MP 23.0 Lt. La Sal Mountain Loop Road, B-84, Looking north

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD

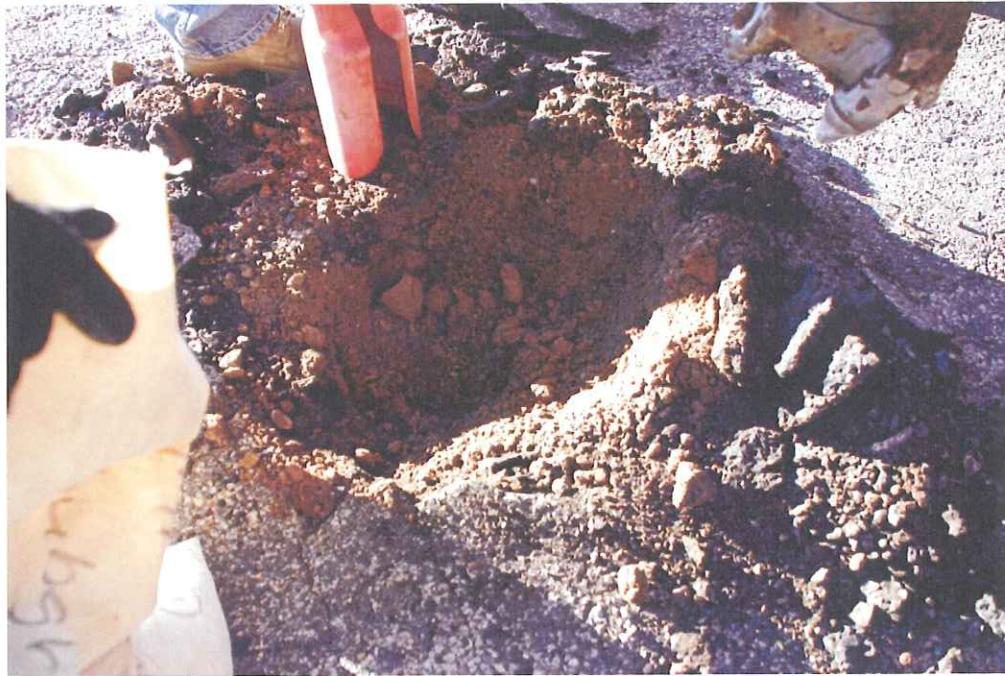


MP 23.0 Lt. La Sal Mountain Loop Road, B-84, Subgrade material



MP 24.0 Rt. La Sal Mountain Loop Road, B-88, Looking north

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 24.0 Rt. La Sal Mountain Loop Road, B-88, Subgrade material



MP 25.0 Lt. La Sal Mountain Loop Road, B-92, Looking north

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



MP 25.0 Lt. La Sal Mountain Loop Road, B-92, Base material



MP 25.0 Lt. La Sal Mountain Loop Road, B-92, Subgrade material

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



Burn Area

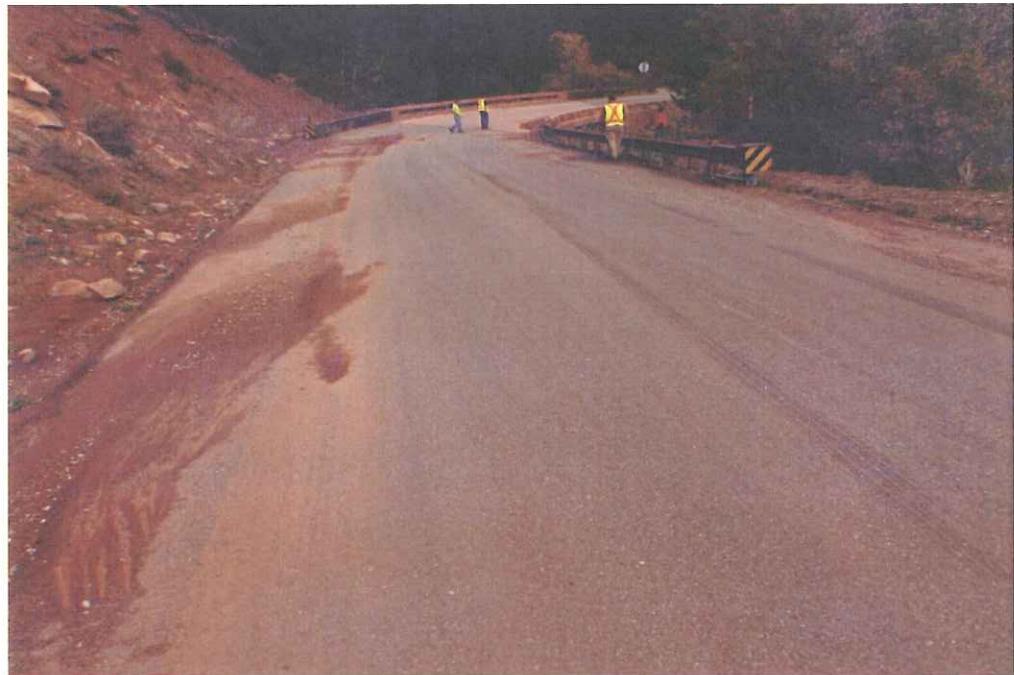


Slide area

UT PFH 46-1 (2) LA SAL MOUNTAIN LOOP ROAD



Wetland Area

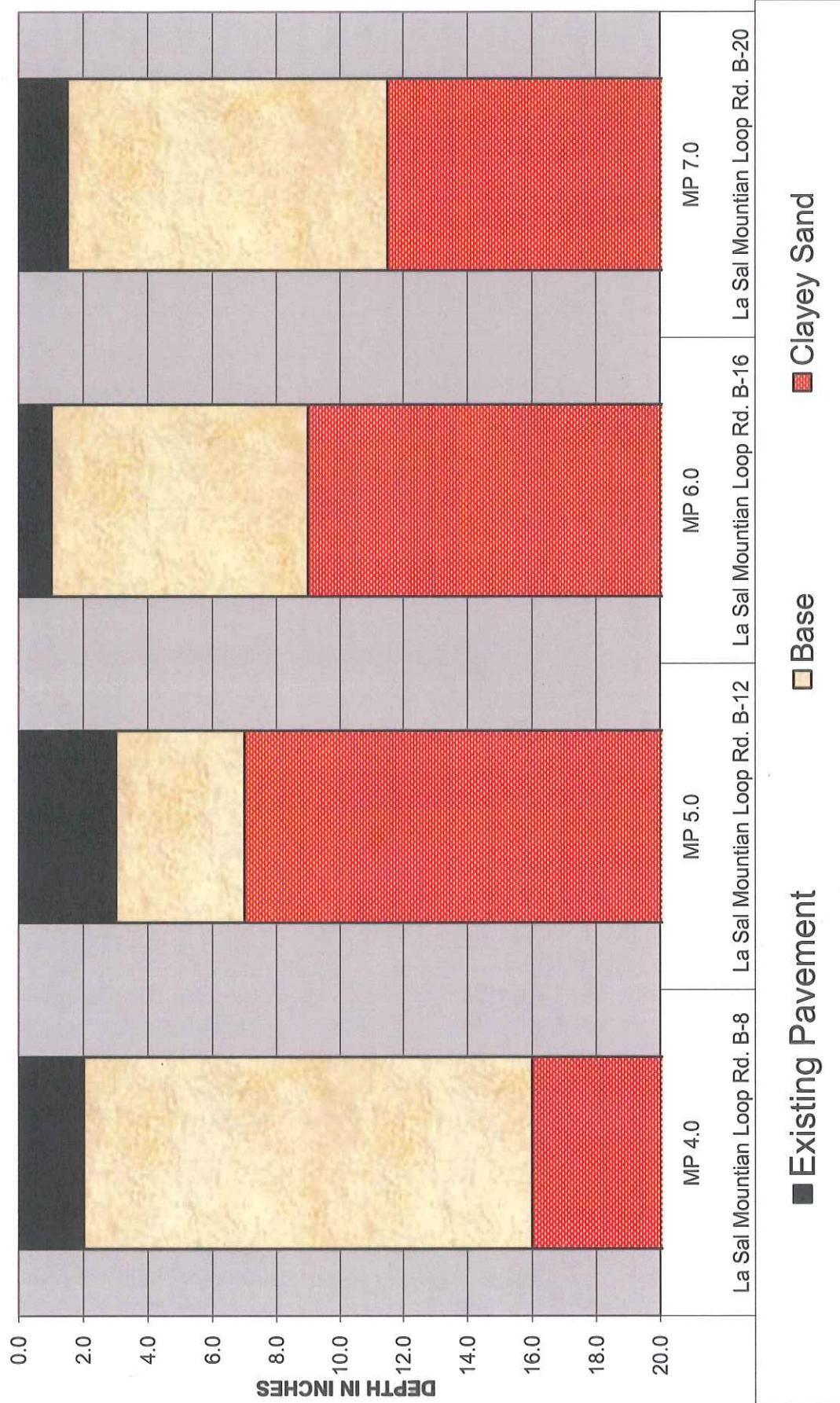


Mill Creek Bridge

APPENDIX D

VISUAL CLASSIFICATION SUMMARY

PAVEMENT & BASE COURSE THICKNESSES
MP 4.0 to 7.0



UT PFH 46-1(2) LA SAL MOUNTAIN LOOP ROAD

PAVEMENT & BASE COURSE THICKNESSES
MP 8.0 to 12.0

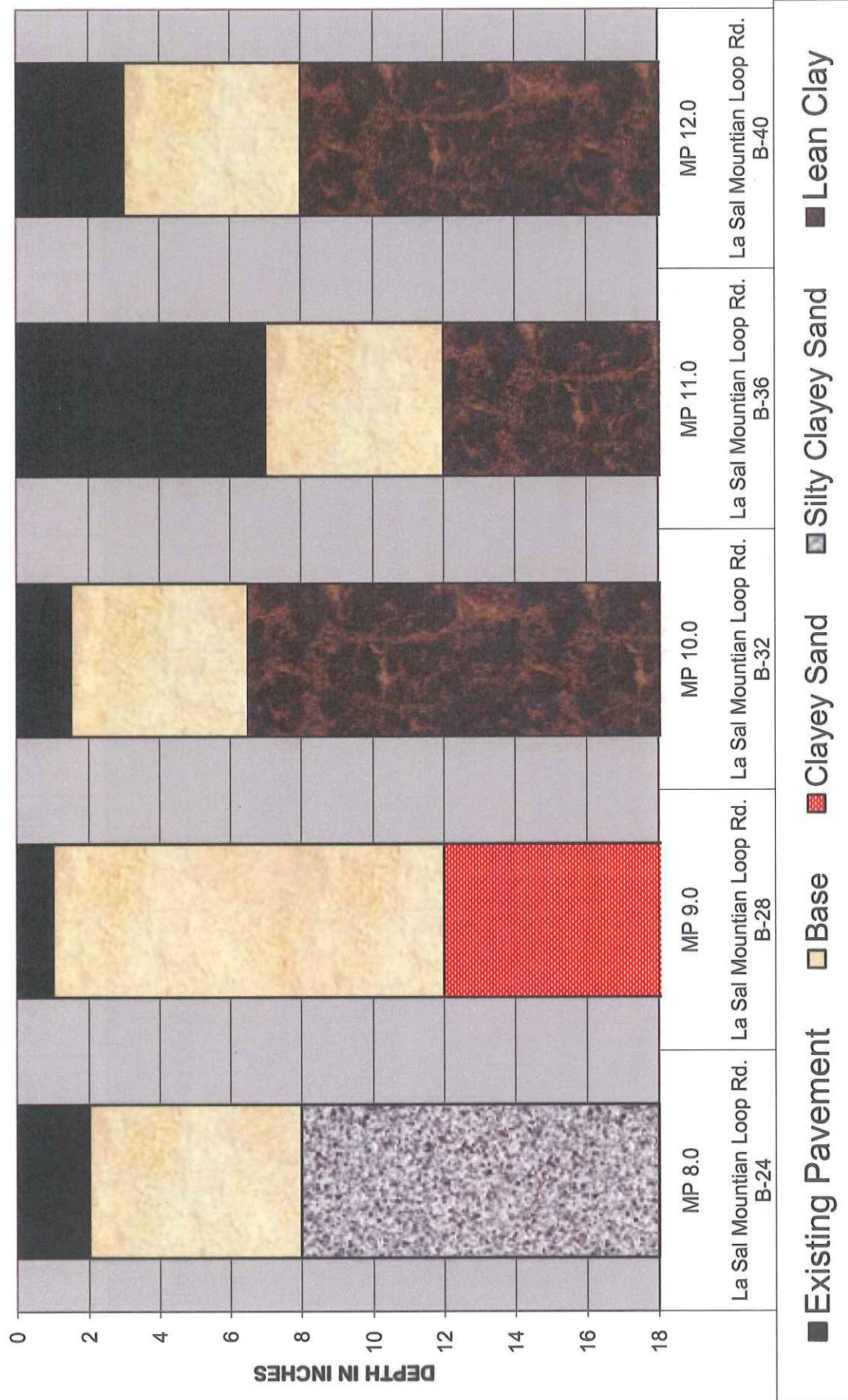


Chart 2

PAVEMENT & BASE COURSE THICKNESSES
MP 13.0 to 17.0

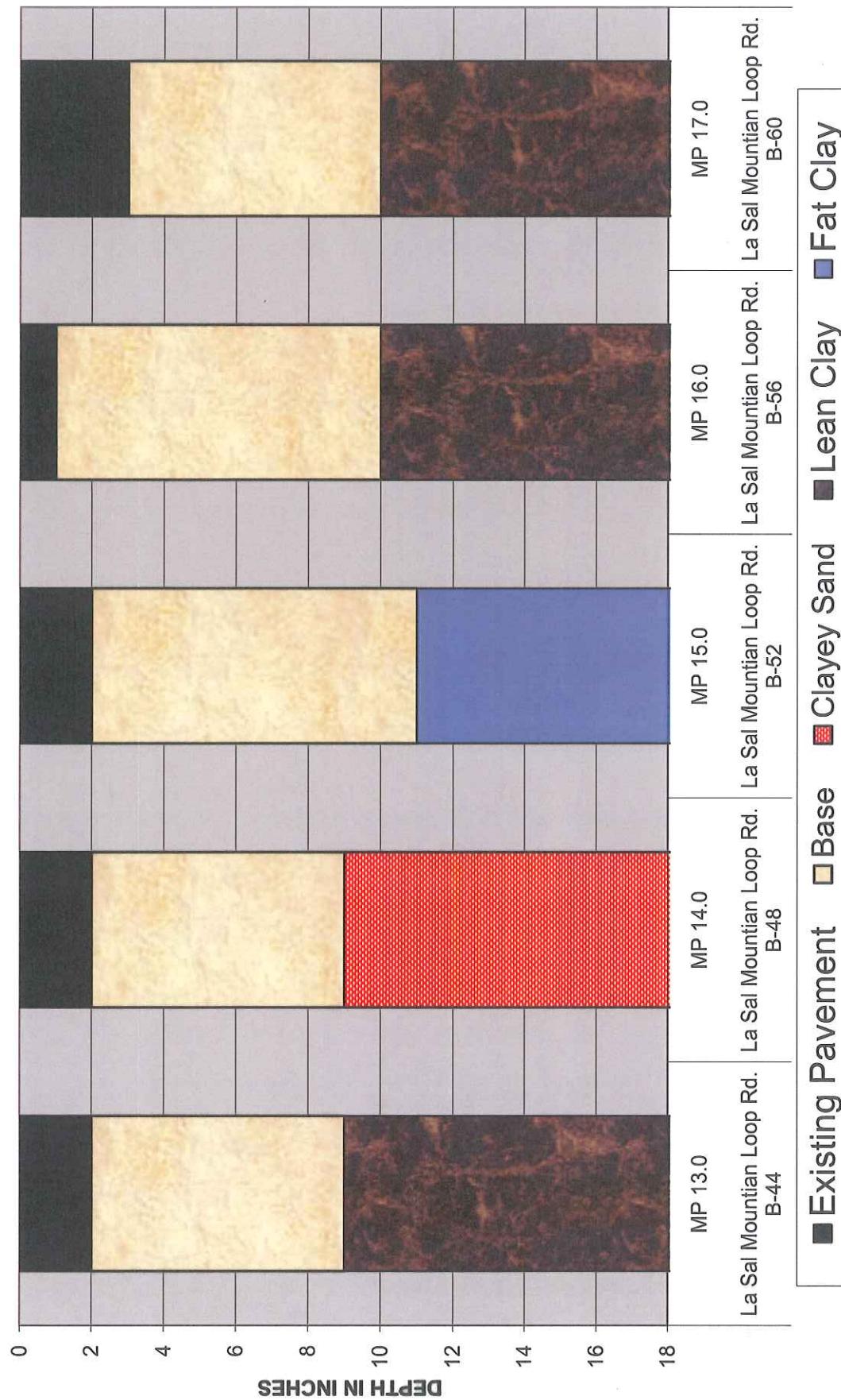


Chart 3

PAVEMENT & BASE COURSE THICKNESSES
MP 18.0 to 25.0

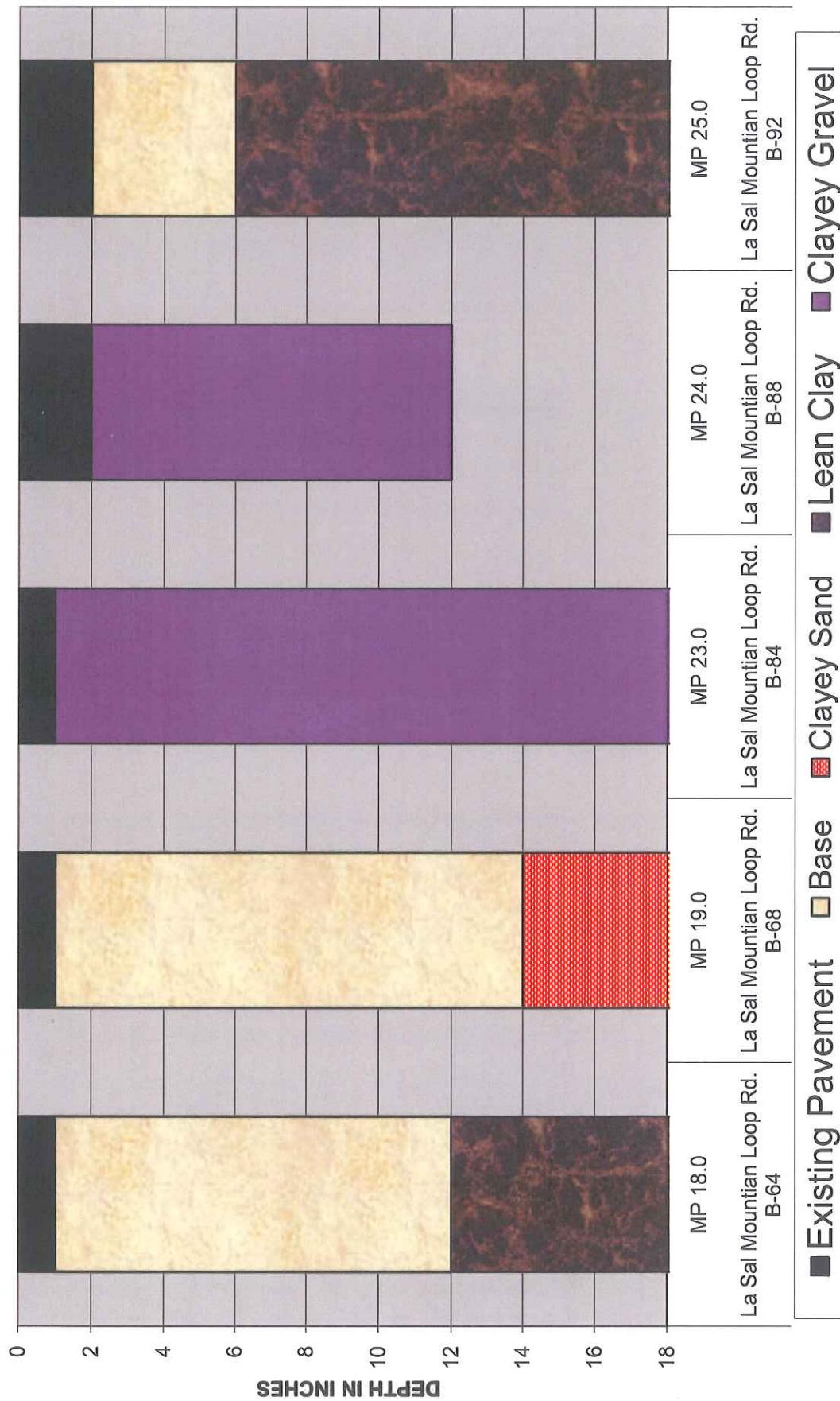


Chart 4

APPENDIX E

PAVEMENT DESIGN CALCULATIONS

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	50,000
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	3,800 psi
Stage Construction	1
Calculated Design Structural Number	2.45 in

Rigorous ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	364
Number of Lanes in Design Direction	1
Percent of All Trucks in Design Lane	100 %
Percent Trucks in Design Direction	50 %

Vehicle Class	Percent of ADT	Annual % Growth	Average Initial Truck Factor (ESALs/Truck)	Annual % Growth in Truck Factor	Accumulated 18-kip ESALs over Performance Period
	2	4	5	7	Total
2	92	2	0.0004	0	582
4	1	2	0.88	0	13,923
5	6	2	0.2	0	18,985
7	1	2	1	0	15,821
Total	100	-	-	-	49,311

Growth Simple

Total Calculated Cumulative ESALs 49,311

Specified Layer Design

<u>Layer</u>	<u>Material Description</u>	<u>Struct Coef. (Ai)</u>	<u>Drain Coef. (Mi)</u>	<u>Thickness (Di)(in)</u>	<u>Width (ft)</u>	<u>Calculated SN (in)</u>
1	HACP	0.44	1	3	-	1.32
2	FDR - Pulverize	0.14	1	6	-	0.84
3	Existing Base	0.12	1	3	-	0.36
Total	-	-	-	12.00	-	2.52

APPENDIX F

PRICE ESTIMATIONS AND ASSUMPTIONS

UT PFH 46-1(2) La Sai Mountain Loop Road
Cost Estimate

UT PFH 46-1(2) La Sal Mountain Loop Road

<u>Option Items</u>	<u>inches convert to feet</u>	<u>feet in mile</u>	<u>width</u>	<u>unit weight</u>	<u>lbs to tons</u>	<u>tons</u>	<u>\$/ ton</u>
Average HACP	width depth	22.50 1.50	feet inches				
Average HACP							
6" Pulverize	6	5280 x	22.50	x	0.1111 =	13,199	x \$ 3.00 = \$ 39,596 (2
3" HACP Lime	3 1%	x 0.0833 x	5280	x	22.50 x	145.2 / 2000 = 2156.22 21.5622 x \$ 100 = \$ 215,622 (3	
Tack	5280 x	22.50 x	0.1111	=	13,199 x 0.1 gal x 1 ton / 241 gal	= 5 x \$ 750 = \$ 4107.47 (5	
Fog	5280 x	22.50 x	0.1111	=	13,199 x 0.1 gal x 1 ton / 241 gal	= 5 x \$ 750 = \$ 4107.47 (6	
Prime	5280 x	22.50 x	0.1111	=	13,199 x 0.33 gal x 1 ton / 253 gal	= 17 x \$ 800 = \$ 13,772.54 (7	
Biotter	5280 x	22.50 x	0.1111	=	13,199 x 14.75 lb x 1 ton / 2000 lb	= 97 x \$ 50 = \$ 4,867.01 (8	
Chip, Designation 2B	5280 x	22.50 x	0.1111	=	13,199 x 0.98 gal/yd ²	13,199 sq yd x \$ 2.5 = \$ 32,997 (10	
Emulsified Asphalt, Grade CrS-2p	5280 x	22.50 x	0.1111	=	/ 261.5 gal/ton = 49 ton x \$ 700 = \$ 34,624 (11		
10 Year	Double Chip Seal + 6" FDR - Pulverize (2 + 6 + 7 + 8 + 12 = 39,596 + 4,107 + 12,773 + 4,857 + 67,621 =						\$67,621 (12)
20 Year	3" HACP + 6" FDR - Pulverize (2 + 3 + 4 + 9 = 39,596 + 24,622 + 4,744 + 26,854 =						\$286,816 per mile